

REMARKS

This Amendment is in response to the Office Action dated May 8, 2001. Claims 1-14 are pending in the present application. In response to an Election Requirement, Applicants have withdrawn claims 1-7 from consideration. Claims 8, 9, and 13 have been amended, and claim 10 has been cancelled. Accordingly, claims 8, 9, and 11-14 are pending in the present application.

Amended Claims

Applicants have amended independent claim 8 to recite that the “thin photoresist layer is between approximately 0.1 to 0.2 μm thick.” Support for this amendment is found in claim 3, as well as, in the Specification at page 4, line 22 to page 5, line 1; page 5, lines 11-12). Claim 8 has also been amended to recite that the thin photoresist layer is used as a mask for the halo implant. Support for this amendment is found in the Specification, page 5, lines 10-13. No new matter has been presented.

Claims 9 and 13 have been amended to provide proper antecedent basis, and therefore, the scopes of claims 9 and 13 remain unchanged. No new matter has been presented.

Objections to Drawings

The Examiner objected to the drawings. The objections are listed, and Applicants' response follows.

Figures 1 and 2 should be designated as Prior Art. Applicants have amended Figures 1 and 2 accordingly, and Figures 1 and 2 are attached for the Examiner's review.

Figure 2 includes reference signal 213, which is not mentioned in the Specification, includes reference signal 212, which designates both the active area and the photoresist mask,

and fails to include reference signal 202, which is mentioned in the Specification. Applicants have amended Figure 2 to designate the halo implant with reference signal 202. The Specification has been amended to state that reference signal 213 refers to the photoresist.

In Figure 2, reference signal 204 has been used to designate both the source and the drain. Applicants have amended Figure 2 to show that reference signal refers only to the source region.

Finally, the Examiner objected to the drawings because they “fail to show ‘the LDD region’ as described in the specification. Any structural detail that is essential for a proper understanding of the disclosed invention should be shown in the drawing.” Applicants respectfully submit that the LDD region is not an essential feature of the disclosed invention. As stated in the Specification, the halo implant is typically performed after a LDD implant. In any event, Applicants submit that Figures 2 and 4 show the LDD regions, a designated by reference signals 204, 206, 404 and 406.

Applicants respectfully submit that with the amendments to the Figures and to the Specification, the Examiner’s objections have been overcome.

35 U.S.C. § 112 Objection

The Examiner rejected claims 8-14 under 35 U.S.C. § 112, 2nd paragraph. The Examiner stated:

Regarding claims 1 and 8, each claim recites the limitation of “the appropriate area”, which is not defined by the Specification and seems to be a relative term.

Regarding claims 2 and 9, each recitation of “the active area” lacks proper antecedent basis.

Regarding claims 6 and 13, each recitation of “the source region and the drain region” lacks proper antecedent basis.

Regarding claim 10, the limitation of “1 to 2 μm thick” is not supported by the Specification.

Claim 8 has been amended to delete reference to “the appropriate area” because as a halo implant, one skilled in the art would know that such an implant, by definition, is targeted at the edges of the source and drain regions and slightly beneath the gate region separating the source and drain. Thus, reference to “the appropriate area” is not needed in claim 8. Moreover, the Specification discusses that the halo implant should be provided underneath the gate area in the targeted area designated by the shaded area in Figures 2 and 4. (Specification, page 5, lines 7-9). Accordingly, Applicants respectfully submit that claim 8, as now presented, satisfies the requirements of 35 U.S.C. §112.

As for claims 9 and 13, Applicants have amended claims 9 and 13 to provide proper antecedent basis for all elements. Claim 10 has been cancelled. Therefore, Applicants respectfully submit that the Examiner rejections under 35 U.S.C. §112 have been overcome.

35 U.S.C. § 102

In the Office Action, claims 8-10 and 13 were rejected under 35 U.S.C. § 102(b) as being anticipated by Ilderem et al. (U.S. Patent 5,675,166) (“Ilderem”). In so doing, the Examiner stated:

Regarding claims 1 and 8, Ilderem et al. teach a semiconductor device (columns 1-8) comprising: a thin photoresist (34) and a halo implant (33, 36) (See Figure 5 and 6).

Regarding claims 2, 6, 9, and 13, Ilderem et al. teach that the thin photoresist (34) covers a substantial amount of source and drain regions (See Figures 4-6 and col. 5, lines 29-30).

Regarding claims 3 and 10, Ilderem et al. teach that the thin photoresist (34) is between about 0.1 to 0.2 μm thick (see col. 5, lines 5-7).

Applicants respectfully traverse. The present invention, as recited in claim 8, provides:

8. A system for providing a halo implant to a semiconductor device comprising:

means for providing a thin photoresist layer to the semiconductor device, wherein the thin photoresist layer is between approximately 0.1 to 0.2 μm thick; and

means for providing the halo implant to the semiconductor device, wherein the thin photoresist layer is used as a mask.

Ilderem is directed to a method of manufacturing a low voltage FET. As part of the method, first and second halo implants are provided on the source side of the gate structure. Accordingly, the drain side of the gate structure, as well as, part of the gate structure, is masked with a photoresist layer. Accordingly to Ilderem, the masking layer is "a thick (e.g., 1.0 micron) photoresist layer, a dielectric layer, or the like." (Col. 4, lines 52-54; col. 5, lines 5-7). (1)

Ilderem fails to teach or suggest a system including "means for providing a thin photoresist layer to the semiconductor device, wherein the thin photoresist layer is between approximately 0.1 to 0.2 μm thick," as recited in claim 8. In the present invention, by utilizing a thin photoresist layer having a thickness of between 0.1 and 0.2 μm , the location of the halo implant is better controlled when the implant angle is approximately 45 degrees. Ilderem makes no mention or suggestion of utilizing a *thin* photoresist layer. Rather, in Ilderem's own words, "a *thick* (e.g., 1.0 micron) photoresist layer" is used.

Accordingly, Ilderem fails to teach or suggest the combination of elements disclosed in the present invention, as recited in claim 8. Applicants respectfully submit that claim 8 is allowable over Ilderem. Claims 9 and 13 depend from claim 8, and therefore the above arguments apply with full force and effect to claims 9 and 13. Applicants respectfully submit that claims 9 and 13 are also allowable over Ilderem.

Moreover, claim 13 is allowable over Ilderem because Ilderem fails to teach or suggest that "the thin photoresist layer covers a substantial amount of an active area of the semiconductor device," as recited in claim 9, wherein "the active area comprises a source region and a drain region of the semiconductor device," as recited in claim 13. In Ilderem, the mask layer does not cover the source region, leaving it exposed so that the halo implant is provided to the source (2)

side only. (Col. 4, lines 50-53; col. 5, lines 3-5). As is seen in Figures 4 and 5, resist layers 32 and 34 mask only the drain region, and leave the source region completely exposed.

Therefore, Ilderem fails to teach or suggest covering “a *substantial* amount of an active area of the semiconductor device,” “wherein the active area comprises *a source region and a drain region* of the semiconductor device,” as recited in claim 13. Accordingly, claim 13 is allowable over Ilderem.

35 U.S.C. §103 Rejections

In the Office Action, the Examiner rejected claims 11, 12 and 14 under 35 U.S.C. §103 as being unpatentable over Ilderem in view of Applicant’s Specification. Applicants submit that claims 11, 12 and 14 depend from claim 8 and that the arguments above apply with full force and effect to claims 11, 12 and 14. Because Ilderem fails to teach or suggest the present invention, as recited in claim 8, the combination of Ilderem and the Applicants’ Specification cannot teach or suggest claims 11, 12 and 14. Accordingly, Applicants respectfully submit that claims 11, 12 and 14 are allowable over the cited references.

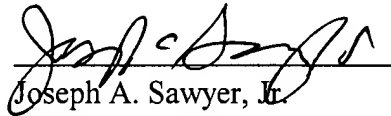
Conclusion

In view of the foregoing, it is submitted that claims 8, 9, and 11-14, as now presented, are allowable over the cited references and are in condition for allowance. Applicants respectfully request reconsideration of the rejections and objections to the claims.

Applicants’ attorney believes that this application is in condition for allowance. Should any unresolved issues remain, Examiner is invited to call Applicants’ attorney at the telephone number indicated below.

Attached hereto and captioned "Version with Markings to Show Changes Made" is a marked-up version of the changes made to the specification and the claims by the current amendment.

Respectfully submitted,

A handwritten signature in black ink, appearing to read "Joseph A. Sawyer, Jr.", written over a horizontal line.

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VERSION WITH MARKINGS TO SHOW CHANGES MADE**IN THE SPECIFICATION:**

Page 2, ¶3, lines 10-14:

Accordingly, in a system and method in accordance with the present invention, a photo photoresist that is capable of thinner profile, i.e., DUV photoresist, is utilized. This will allow one to lower the photoresist thickness to the proposed 1000A (in the field) or lower if the process allows. With this photoresist thickness, taking into account other height variables, the source and drain regions can be opened only as needed.

Page 4, ¶¶ 2, 3, lines 7-20:

Figure 2 is a diagram illustrating the semiconductor device 200 after a conventional halo implant. Accordingly oftentimes the halo implant 202 ends up providing dopant to all of the source region 204 and drain region 206. Since only the area directly underneath the gate 208 is the area of interest for the implant (indicated by shading), there is leakage and other problems associated therewith. Accordingly, the entire active area 212 is open primarily because the thickness of the photoresist mask ~~212~~213 is such that at a 45° angle, the ultraviolet rays cannot accurately be provided underneath the gate area.

As is seen, with a photoresist mask ~~212~~213 thickness of 0.5µm, the 45° angle will require that a large portion of the ultraviolet radiation will not reach the area of interest (indicated by shading) because at that angle, with the thick photoresist, it is not possible. In addition, if a thick photoresist of (0.5µm or greater) is placed over the trench oxidation 207, due to the soft jelly type nature of the photoresist, oftentimes the photoresist will fall over in the trench oxidation area and

cover areas that are to be implanted. Even if the photoresist stands erect, at the smaller process technologies, the halo implant will not reach the targeted areas.

IN THE CLAIMS:

8. (Amended) A system for providing a halo implant to a semiconductor device comprising:

means for providing a thin photoresist layer to the semiconductor device, wherein the thin photoresist layer is between approximately 0.1 to 0.2 μ m thick; and

means for providing the halo implant to the ~~appropriate area of the~~ semiconductor device, wherein the thin photoresist layer is used as a mask.

9. (Amended) The system of claim 8 wherein the thin photoresist layer covers a substantial amount of ~~the an~~ active area of the semiconductor device.

13. (Amended) The system of claim 9 wherein the active area comprises ~~the a~~ source region and ~~the a~~ drain region of the semiconductor device.